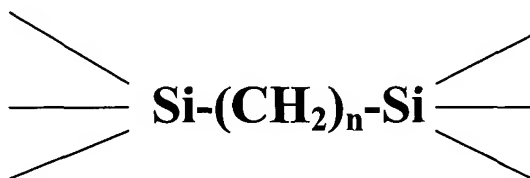


THE CLAIMS

What is claimed is:

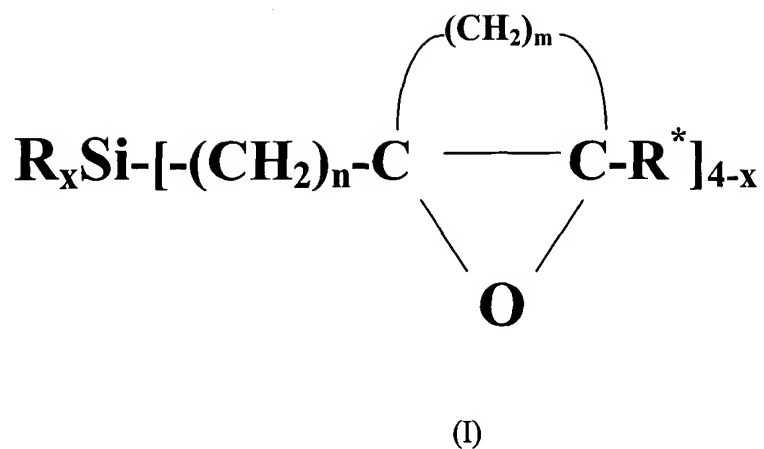
1. An organosilicon precursor for vapor deposition of a low k, high strength dielectric film, wherein the precursor comprises at least one of:

- (i) silicon-pendant oxiranyl functionality; and
- (ii) a disilyl moiety of the formula



wherein x is an integer having a value of from 0 to 4 inclusive.

2. The organosilicon precursor of claim 1, selected from the group consisting of oxiranylsilane compounds of formula (I) and disilane compounds of formula (III):

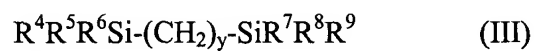


wherein:

m is an integer having a value of 0 to 6, inclusive;

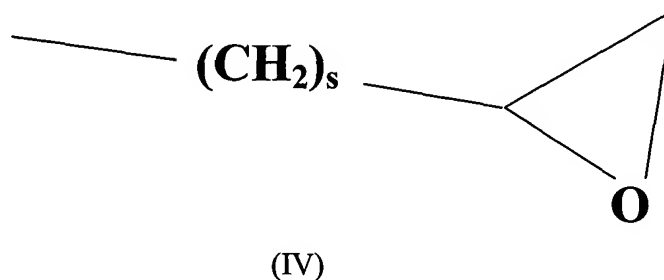
x is an integer having a value of 0 to 3, inclusive; and

each R and R* can be the same as or different from one another and each is independently selected from the group consisting of H, C₁-C₈ alkyl, C₁-C₈ fluoroalkyl, C₁-C₈ alkoxy, C₆-C₁₀ cycloalkyl, C₆-C₁₀ aryl, C₆-C₁₀ fluoroaryl, C₂-C₆ vinyl, and C₃-C₆ allyl; and



wherein:

each of R^4 , R^5 , R^6 , R^7 , R^8 and R^9 can be the same as or different from one another and each is independently selected from the group consisting of H, C_1 - C_8 alkyl, C_1 - C_8 fluoroalkyl, C_1 - C_8 alkoxy, C_6 - C_{10} cycloalkyl, C_6 - C_{10} aryl, C_6 - C_{10} fluoroaryl, C_2 - C_6 vinyl, C_3 - C_6 allyl, and oxiranylalkylene of formula (IV)

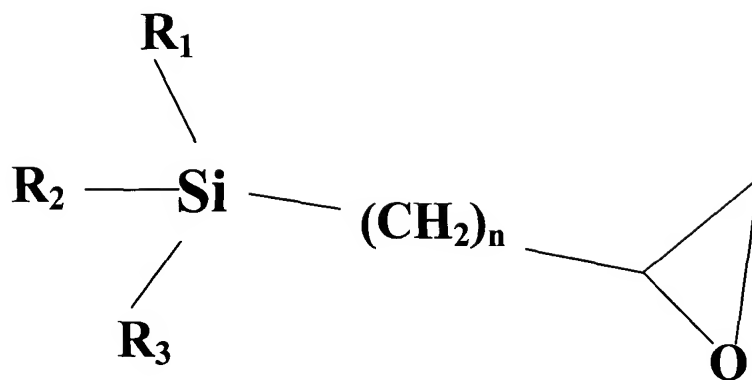


wherein s is 0 or 1; and

y is an integer having a value of from 0 to 4 inclusive.

3. The organosilicon precursor of claim 1, having the formula (I).

4. The organosilicon precursor of claim 1, having the formula (II):



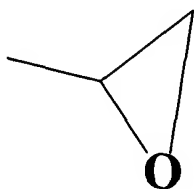
(II)

wherein:

each of R_1 , R_2 and R_3 can be the same as or different from one another and each is independently selected from the group consisting of H, $\text{C}_1\text{-C}_8$ alkyl, $\text{C}_1\text{-C}_8$ fluoroalkyl, $\text{C}_1\text{-C}_8$ alkoxy, $\text{C}_6\text{-C}_{10}$ cycloalkyl, $\text{C}_6\text{-C}_{10}$ aryl, $\text{C}_6\text{-C}_{10}$ fluoroaryl, $\text{C}_2\text{-C}_6$ vinyl, and $\text{C}_3\text{-C}_6$ allyl; and

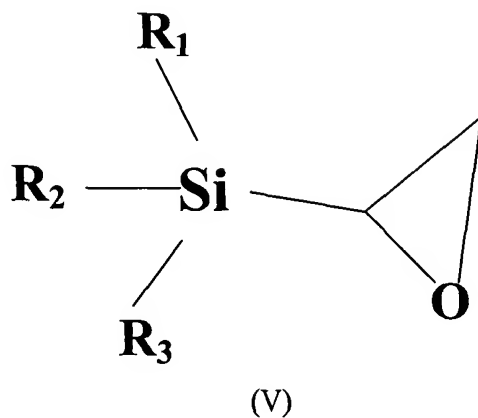
n is 0 or 1;

with the proviso that if $n = 1$, then one of R_1 , R_2 and R_3 alternatively can be



an oxiranyl functionality.

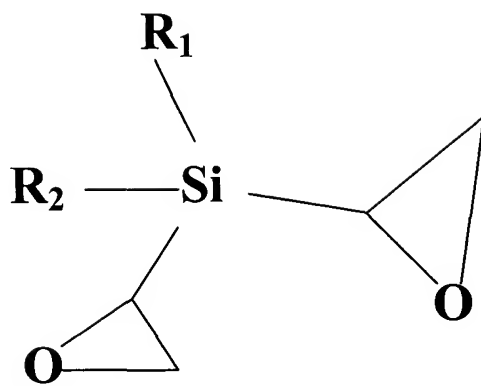
5. The organosilicon precursor of claim 1, having the formula (V):



wherein:

each of R_1 , R_2 and R_3 is independently selected from the group consisting of H, C_1 - C_8 alkyl, C_1 - C_8 fluoroalkyl, C_1 - C_8 alkoxy, C_6 - C_{10} cycloalkyl, C_6 - C_{10} aryl, C_6 - C_{10} fluoroaryl, C_2 - C_6 vinyl, and C_3 - C_6 allyl.

6. The organosilicon precursor of claim 1, having the formula (VI):

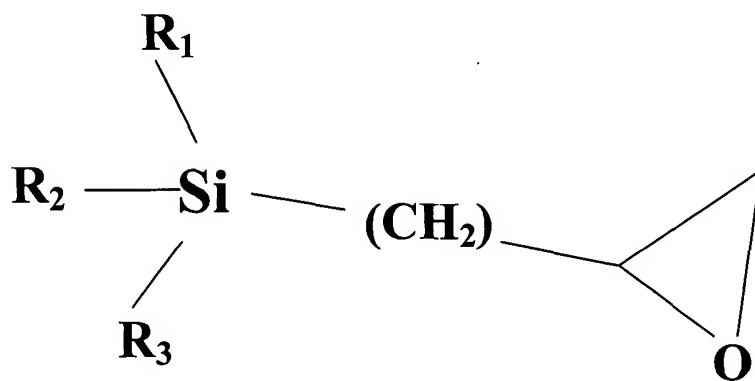


(VI)

wherein:

each of R₁ and R₂ is independently selected from the group consisting of H, C₁-C₈ alkyl, C₁-C₈ fluoroalkyl, C₁-C₈ alkoxy, C₆-C₁₀ cycloalkyl, C₆-C₁₀ aryl, C₆-C₁₀ fluoroaryl, C₂-C₆ vinyl, and C₃-C₆ allyl.

7. The organosilicon precursor of claim 1, having the formula (VII):

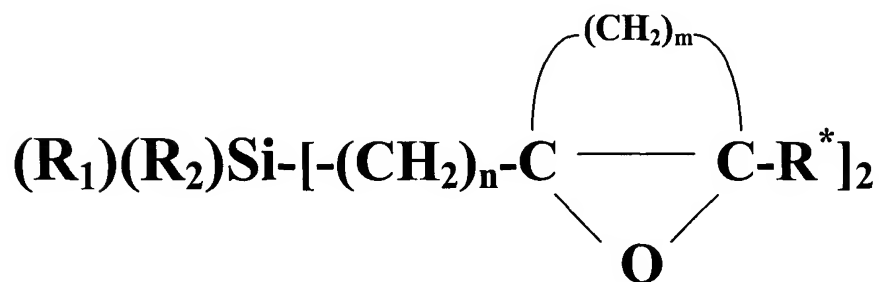


(VII)

wherein:

each of R_1 , R_2 and R_3 is independently selected from the group consisting of H, C_1 - C_8 alkyl, C_1 - C_8 fluoroalkyl, C_1 - C_8 alkoxy, C_6 - C_{10} cycloalkyl, C_6 - C_{10} aryl, C_6 - C_{10} fluoroaryl, C_2 - C_6 vinyl, and C_3 - C_6 allyl.

8. The organosilicon precursor of claim 1, having the formula (VIII):



wherein:

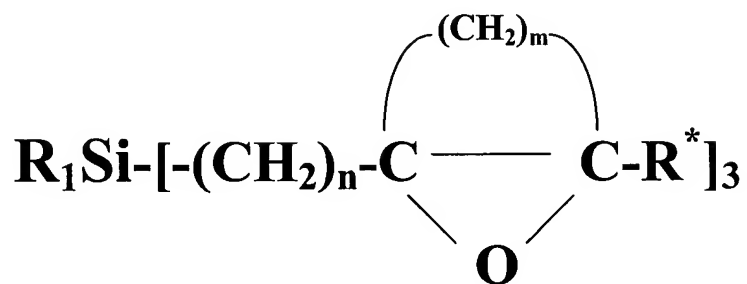
m is an integer having a value of from 0 to 6 inclusive;

n is 0 or 1;

each R_1 , R_2 and R^* can be the same as or different from one another and each is independently selected from the group consisting of H, C_1 - C_8 alkyl, C_1 - C_8 fluoroalkyl,

C₁-C₈ alkoxy, C₆-C₁₀ cycloalkyl, C₆-C₁₀ aryl, C₆-C₁₀ fluoroaryl, C₂-C₆ vinyl, and C₃-C₆ allyl.

9. The organosilicon precursor of claim 1, having the formula (IX):



wherein:

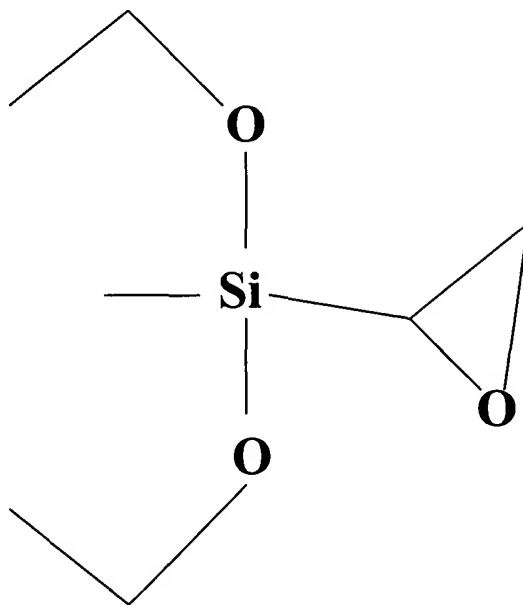
m is an integer having a value of from 0 to 6 inclusive;

n is 0 or 1;

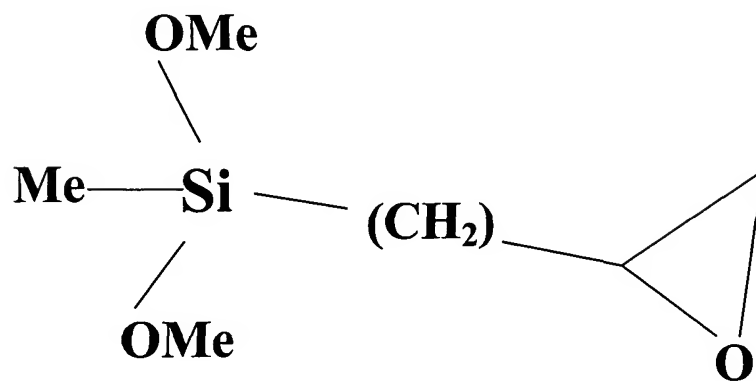
each of R₁ and R^{*} can be the same as or different from one another and each is independently selected from the group consisting of H, C₁-C₈ alkyl, C₁-C₈ fluoroalkyl, C₁-C₈ alkoxy, C₆-C₁₀ cycloalkyl, C₆-C₁₀ aryl, C₆-C₁₀ fluoroaryl, C₂-C₆ vinyl, and C₃-C₆ allyl.

10. The organosilicon precursor of claim 1, selected from the group consisting of compounds of Formula (A), Formula (B) and Formula (C):

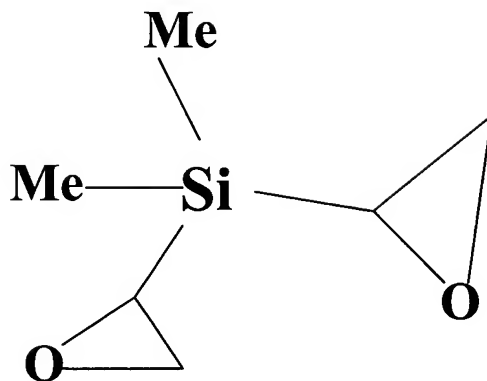
Formula (A), $\text{Me}(\text{EtO})_2\text{SiCHCH}_2\text{O}$:



Formula (B), $\text{Me}(\text{MeO})_2\text{SiCH}_2\text{CHCH}_2\text{O}$:



Formula (C), $\text{Me}_2\text{Si}(\text{CHCH}_2\text{O})_2$:



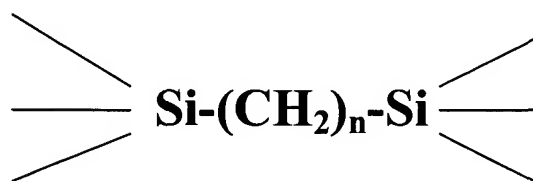
wherein Me is methyl.

11. The organosilicon precursor of claim 10, having Formula (A).
12. The organosilicon precursor of claim 10, having Formula (B).
13. The organosilicon precursor of claim 10, having Formula (C).
14. The organosilicon precursor of claim 2, selected from the group consisting of disilane compounds of formula (III).
15. The organosilicon precursor of claim 14, wherein x is 0.

16. The organosilicon precursor of claim 14, wherein x is 1.
17. The organosilicon precursor of claim 14, wherein x is 2.
18. The organosilicon precursor of claim 1, wherein the precursor further comprises TMCTS.
19. An organosilicon precursor composition for vapor deposition of a low k, high strength dielectric film, wherein the composition comprises:

(A) an organosilicon precursor comprising at least one of:

- (iii) silicon-pendant oxiranyl functionality; and
- (iv) a disilyl moiety of the formula



wherein x is an integer having a value of from 0 to 4 inclusive; and

(B) a porogen.

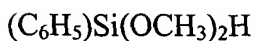
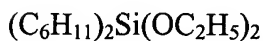
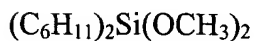
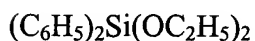
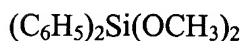
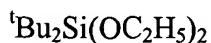
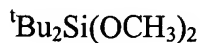
20. The organosilicon precursor composition of claim 19, wherein said porogen is selected from the group consisting of compounds of the formula (X):

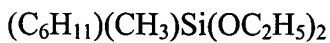
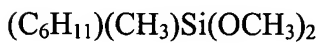
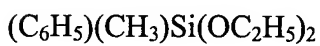
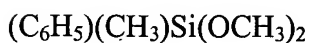
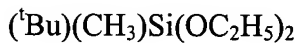
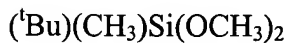
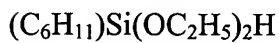
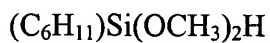
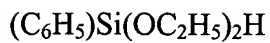


wherein:

each of R^{10} , R^{11} , R^{12} and R^{13} can be the same as or different from one another and each is independently selected from the group consisting of H, C₁-C₈ alkyl, C₁-C₈ alkoxyl, C₆-C₁₀ cycloalkyl, and C₆-C₁₀ aryl, with the proviso that at least one of R^{10} , R^{11} , R^{12} and R^{13} is C₁-C₈ alkoxyl.

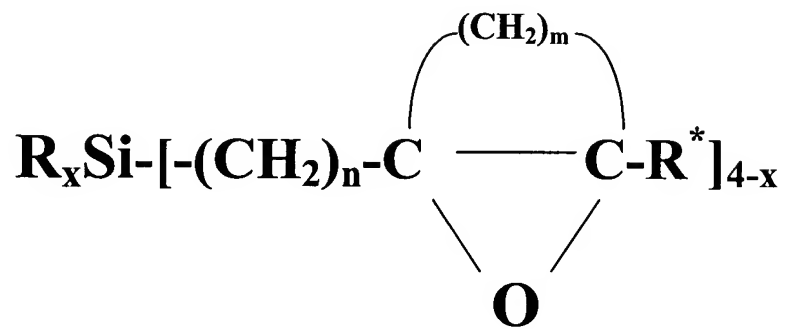
21. The organosilicon precursor composition of claim 19, wherein said porogen is selected from the group consisting of:





wherein ${}^t\text{Bu}$ is tertiary butyl.

22. A method of forming an oxiranylsilane compound of formula (I):



wherein:

m is an integer having a value of 0 to 6, inclusive;

n is 0 or 1;

x is an integer having a value of 0 to 3, inclusive; and

each R and R^{*} can be the same as or different from one another and each is independently selected from the group consisting of H, C₁-C₈ alkyl, C₁-C₈ fluoroalkyl, C₁-C₈ alkoxy, C₆-C₁₀ cycloalkyl, C₆-C₁₀ aryl, C₆-C₁₀ fluoroaryl, C₂-C₆ vinyl, and C₃-C₆ allyl,

said method comprising oxidizing a corresponding vinylsilane or allylsilane compound.

23. The method of claim 22, wherein the step of oxidizing comprises reaction with an oxidizing agent that is inert in relation to Si-OR fragments.

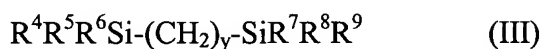
24. The method of claim 23, wherein said oxidizing agent comprises an agent selected from the group consisting of meta-Cl(C₆H₄)C(O)OOH, ^tBuOOH, wherein ^tBu is tertiary butyl, and Me₃OOSiMe₃, wherein Me is methyl.

25. The method of claim 23, wherein said oxidizing agent comprises meta-Cl(C₆H₄)C(O)OOH.

26. The method of claim 22, wherein said step of oxidizing is conducted in a non-flammable solvent medium.
27. The method of claim 26, wherein said non-flammable solvent medium comprises dichloromethane.
28. The method of claim 26, wherein said non-flammable solvent medium comprises chloroform.
29. The method of claim 22, wherein said oxiranylsilane compound is $\text{Me}(\text{EtO})_2\text{SiCHCH}_2\text{O}$.
30. The method of claim 29, wherein said oxidizing step comprises Reaction (1).
31. The method of claim 22, wherein said oxiranylsilane is $\text{Me}(\text{MeO})_2\text{SiCH}_2\text{CHCH}_2\text{O}$.
32. The method of claim 31, wherein said oxidizing step comprises Reaction (2).
33. The method of claim 22, wherein said oxiranylsilane is $\text{Me}_2\text{Si}(\text{CHCH}_2\text{O})_2$.

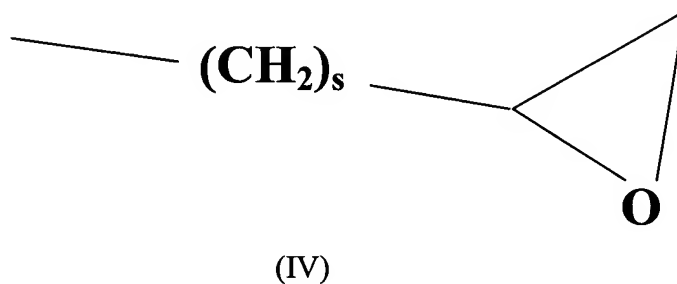
34. The method of claim 33, wherein said oxidizing step comprises Reaction (3).

35. A method of synthesizing a bridged disilane compound of synthesizing a bridged disilane compound of formula (III):



wherein:

each of R^4 , R^5 , R^6 , R^7 , R^8 and R^9 can be the same as or different from one another and each is independently selected from the group consisting of H, C_1 - C_8 alkyl, C_1 - C_8 fluoroalkyl, C_1 - C_8 alkoxy, C_6 - C_{10} cycloalkyl, C_6 - C_{10} aryl, C_6 - C_{10} fluoroaryl, C_2 - C_6 vinyl, C_3 - C_6 allyl, and oxiranylalkylene of formula (IV)



wherein s is 0 or 1; and

y is an integer having a value of from 0 to 4 inclusive,

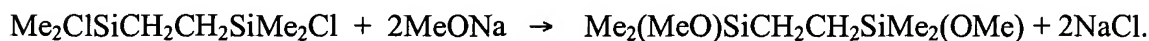
said method comprising derivatization of a corresponding bridged chlorosilane.

36. The method of claim 35, wherein said derivatization step comprises reacting said corresponding bridged chlorosilane with tetraalkylsodium to alkylate said corresponding bridged chlorosilane.

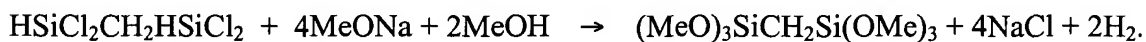
37. The method of claim 35, wherein said derivatization step comprises the reaction



38. The method of claim 35, wherein said derivatization step comprises the reaction



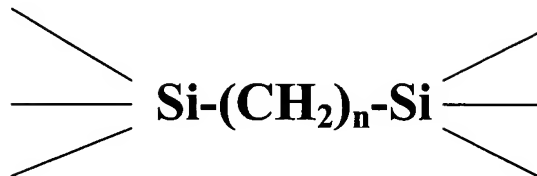
39. The method of claim 35, wherein said derivatization step comprises the reaction



40. A method of forming a low k, high strength dielectric film on a substrate, comprising vapor depositing said film on the substrate from a precursor comprising at least one of:

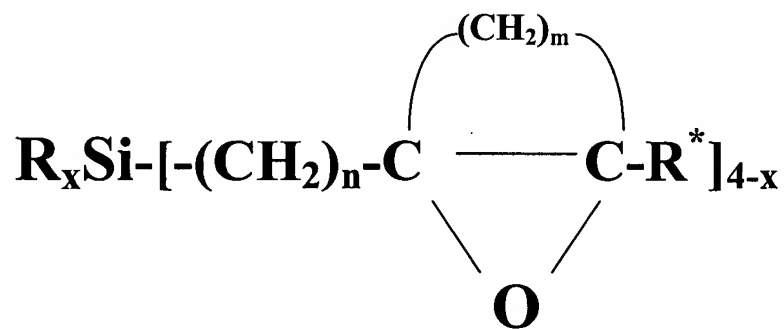
- (i) silicon-pendant oxiranyl functionality; and

(ii) a disilyl moiety of the formula



wherein x is an integer having a value of from 0 to 4 inclusive.

41. The method of claim 40, wherein said precursor is selected from the group consisting of oxiranylsilane compounds of formula (I) and disilane compounds of formula (III):



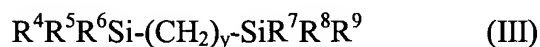
(I)

wherein:

m is an integer having a value of 0 to 6, inclusive;

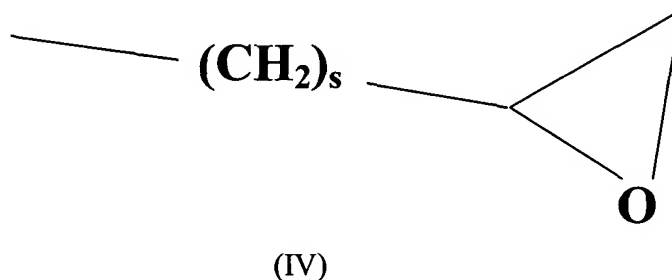
x is an integer having a value of 0 to 3, inclusive; and

each R and R^{*} can be the same as or different from one another and each is independently selected from the group consisting of H, C₁-C₈ alkyl, C₁-C₈ fluoroalkyl, C₁-C₈ alkoxy, C₆-C₁₀ cycloalkyl, C₆-C₁₀ aryl, C₆-C₁₀ fluoroaryl, C₂-C₆ vinyl, and C₃-C₆ allyl; and



wherein:

each of R⁴, R⁵, R⁶, R⁷, R⁸ and R⁹ can be the same as or different from one another and each is independently selected from the group consisting of H, C₁-C₈ alkyl, C₁-C₈ fluoroalkyl, C₁-C₈ alkoxy, C₆-C₁₀ cycloalkyl, C₆-C₁₀ aryl, C₆-C₁₀ fluoroaryl, C₂-C₆ vinyl, C₃-C₆ allyl, and oxiranylalkylene of formula (IV)

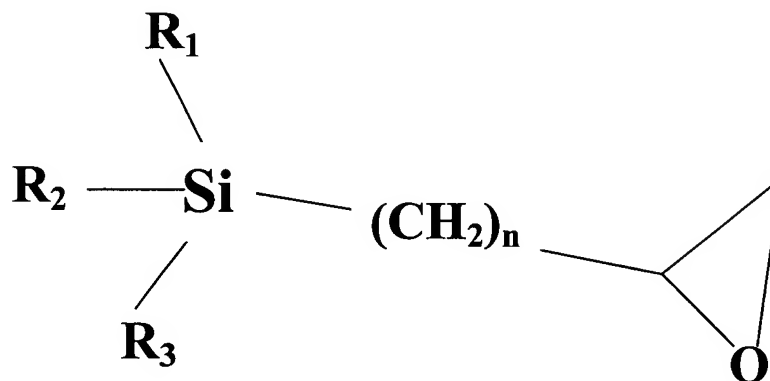


wherein s is 0 or 1; and

y is an integer having a value of from 0 to 4 inclusive.

42. The method of claim 41, wherein the precursor comprises a compound selected from the group consisting of oxiranylsilane compounds of formula (I).

43. The method of claim 41, wherein the precursor comprises a compound having the formula (II):



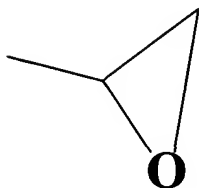
(II)

wherein:

each of R₁, R₂ and R₃ can be the same as or different from one another and each is independently selected from the group consisting of H, C₁-C₈ alkyl, C₁-C₈ fluoroalkyl, C₁-C₈ alkoxy, C₆-C₁₀ cycloalkyl, C₆-C₁₀ aryl, C₆-C₁₀ fluoroaryl, C₂-C₆ vinyl, and C₃-C₆ allyl; and

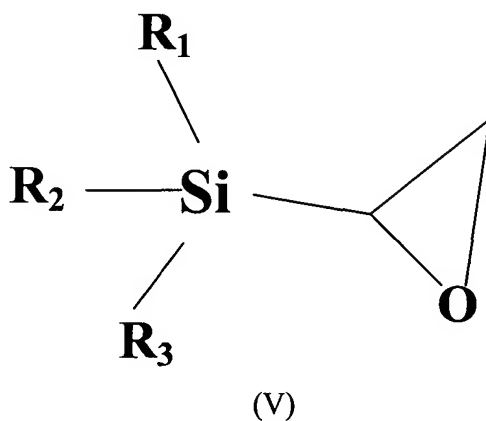
n is 0 or 1;

with the proviso that if $n = 1$, then one of R_1 , R_2 and R_3 alternatively can be



an oxiranyl functionality.

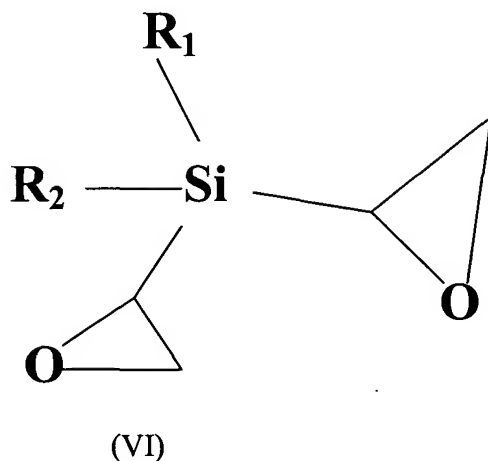
44. The method of claim 41, wherein the precursor comprises a compound having the formula (V):



wherein:

each of R_1 , R_2 and R_3 is independently selected from the group consisting of H, C_1 - C_8 alkyl, C_1 - C_8 fluoroalkyl, C_1 - C_8 alkoxy, C_6 - C_{10} cycloalkyl, C_6 - C_{10} aryl, C_6 - C_{10} fluoroaryl, C_2 - C_6 vinyl, and C_3 - C_6 allyl.

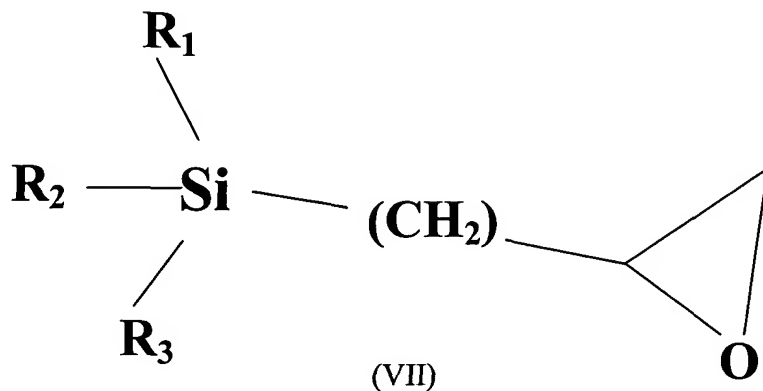
45. The method of claim 41, wherein the precursor comprises a compound having the formula (VI):



wherein:

each of R₁ and R₂ is independently selected from the group consisting of H, C₁-C₈ alkyl, C₁-C₈ fluoroalkyl, C₁-C₈ alkoxy, C₆-C₁₀ cycloalkyl, C₆-C₁₀ aryl, C₆-C₁₀ fluoroaryl, C₂-C₆ vinyl, and C₃-C₆ allyl.

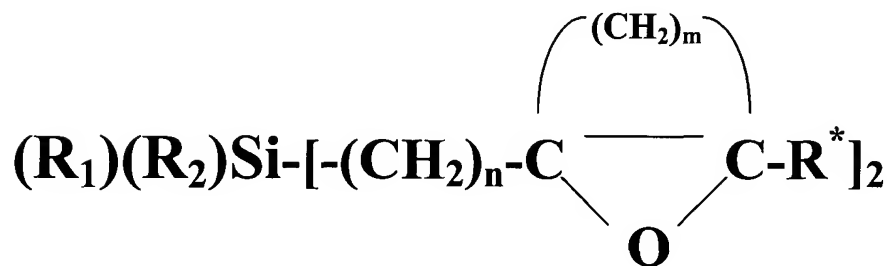
46. The method of claim 41, wherein the precursor comprises a compound having the formula (VII):



wherein:

each of R_1 , R_2 and R_3 is independently selected from the group consisting of H, C_1 - C_8 alkyl, C_1 - C_8 fluoroalkyl, C_1 - C_8 alkoxy, C_6 - C_{10} cycloalkyl, C_6 - C_{10} aryl, C_6 - C_{10} fluoroaryl, C_2 - C_6 vinyl, and C_3 - C_6 allyl.

47. The method of claim 41, wherein the precursor comprises a compound having the formula (VIII):



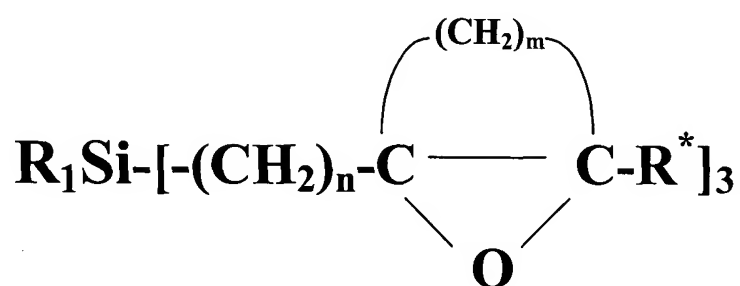
wherein:

m is an integer having a value of from 0 to 6 inclusive;

n is 0 or 1;

each R_1 , R_2 and R^* can be the same as or different from one another and each is independently selected from the group consisting of H, C_1 - C_8 alkyl, C_1 - C_8 fluoroalkyl, C_1 - C_8 alkoxy, C_6 - C_{10} cycloalkyl, C_6 - C_{10} aryl, C_6 - C_{10} fluoroaryl, C_2 - C_6 vinyl, and C_3 - C_6 allyl.

48. The method of claim 41, wherein the precursor comprises a compound having the formula (IX):



(IX)

wherein:

m is an integer having a value of from 0 to 6 inclusive;

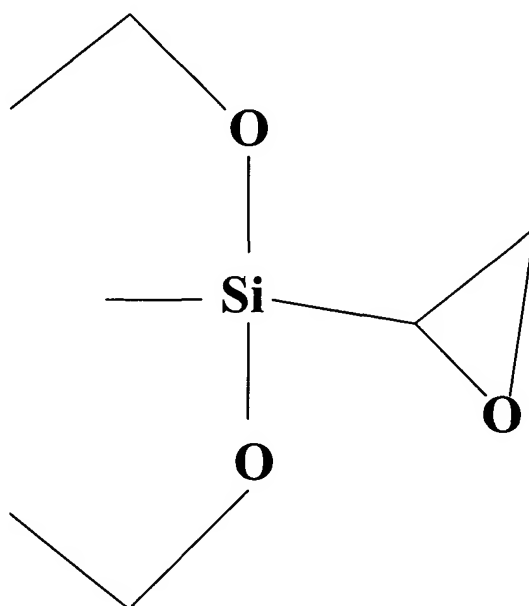
n is 0 or 1;

each of R_1 and R^* can be the same as or different from one another and each is independently selected from the group consisting of H, C_1 - C_8 alkyl, C_1 - C_8 fluoroalkyl,

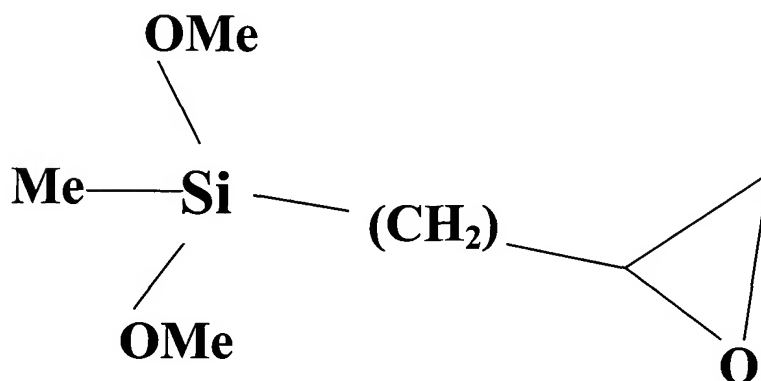
C₁-C₈ alkoxy, C₆-C₁₀ cycloalkyl, C₆-C₁₀ aryl, C₆-C₁₀ fluoroaryl, C₂-C₆ vinyl, and C₃-C₆ allyl.

49. The method of claim 41, wherein the precursor comprises a compound selected from the group consisting of compounds of Formula (A), Formula (B) and Formula (C):

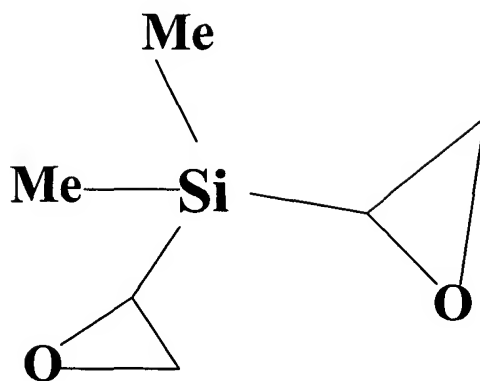
Formula (A), Me(EtO)₂SiCHCH₂O :



Formula (B), Me(MeO)₂Si CH₂CHCH₂O :



Formula (C), $\text{Me}_2\text{Si}(\text{CHCH}_2\text{O})_2$:



wherein Me is methyl.

50. The method of claim 49, wherein the precursor comprises a compound of Formula (A).

51. The method of claim 49, wherein the precursor comprises a compound of Formula (B).

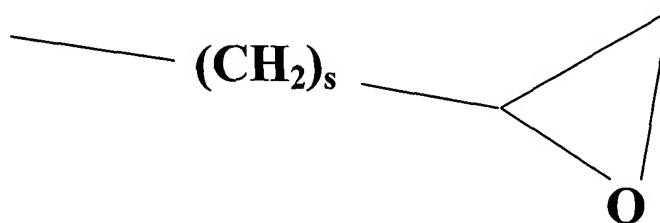
52. The method of claim 49, wherein the precursor comprises a compound of Formula (C).

53. The method of claim 41, wherein said precursor is selected from the group consisting of disilane compounds of formula (III):



wherein:

each of R^4 , R^5 , R^6 , R^7 , R^8 and R^9 can be the same as or different from one another and each is independently selected from the group consisting of H, C_1 - C_8 alkyl, C_1 - C_8 fluoroalkyl, C_1 - C_8 alkoxy, C_6 - C_{10} cycloalkyl, C_6 - C_{10} aryl, C_6 - C_{10} fluoroaryl, C_2 - C_6 vinyl, C_3 - C_6 allyl, and oxiranylalkylene of formula (IV)



(IV)

wherein s is 0 or 1; and

y is an integer having a value of from 0 to 4 inclusive.

54. The method of claim 53, wherein x is 0.

55. The method of claim 53, wherein x is 1.

56. The method of claim 53, wherein x is 2.

57. The method of claim 40, wherein said vapor depositing step comprises use of a porogen in combination with said precursor.

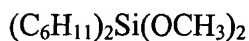
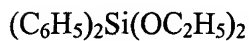
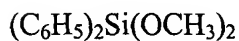
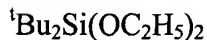
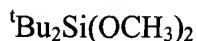
58. The method of claim 57, wherein said porogen is selected from the group consisting of compounds of the formula (X):

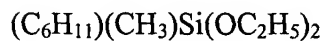
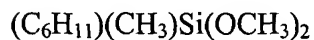
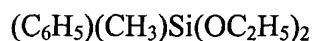
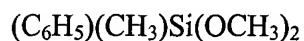
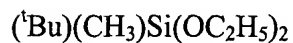
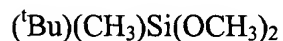
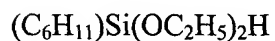
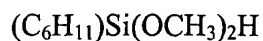
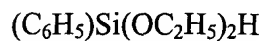
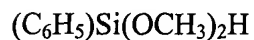


wherein:

each of R^{10} , R^{11} , R^{12} and R^{13} can be the same as or different from one another and each is independently selected from the group consisting of H, C₁-C₈ alkyl, C₁-C₈ alkoxy, C₆-C₁₀ cycloalkyl, and C₆-C₁₀ aryl, with the proviso that at least one of R^{10} , R^{11} , R^{12} and R^{13} is C₁-C₈ alkoxy.

59. The method of claim 57, wherein said porogen is selected from the group consisting of:





wherein ^tBu is tertiary butyl.

60. The method of claim 40, wherein said vapor depositing step comprises chemical vapor deposition.

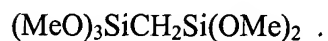
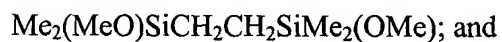
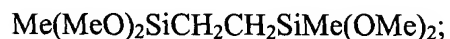
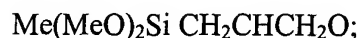
61. The method of claim 40, wherein said vapor depositing step comprises plasma-enhanced chemical vapor deposition.

62. The method of claim 40, wherein said vapor depositing step comprises flowing said precursor to a vapor deposition locus in a carrier gas.

63. The method of claim 62, wherein said carrier gas comprises carbon dioxide.

64. The method of claim 62, wherein the precursor and the carrier gas are the only potential sources of oxygen at the vapor deposition locus.

65. The method of claim 40, wherein the precursor is selected from the group consisting of:



66. The method of claim 40, wherein the precursor further comprises TMCTS.